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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Brian A. Urbach
Serial No. : 10/047,534
Filed : January 15, 2002
For : BALL JOINT WITH DUAL
TAPERED CONNECTION
Group Art Unit : 3679
Examiner : Ernesto Garcia
Attorney Docket No. : TRW(M) 5857

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APPEAL BRIEF

Sir:

Pursuant to the Notice of Appeal filed on May 11, 2005,
Appellant presents this Appeal Brief.

I. REAL PARTY IN INTEREST

The real party in interest is TRW Automotive U.S. LLC. An assignment of this application to TRW, Inc. was recorded January 15, 2002, Reel/Frame: 012496/0614. This application has been subsequently assigned to TRW Automotive U.S. LLC via an unrecorded assignment.

II. RELATED APPEAL AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

Claims 1-12, which are attached in Appendix A, are currently pending in this application. Claims 1-12 stand rejected as failing to meet the written description requirement of 35 U.S.C. §112, first paragraph. Claims 1, 5-8, and 10-12 also stand rejected as being obvious under 35 U.S.C. §103 over Stroh, U.S. Patent No. 6,257,795, in view of Sommerer, U.S. Patent No. 5,062,655. Claims 2-4 stand rejected as being obvious under 35 U.S.C. §103 over Stroh in view of Sommerer and Greubel et al., U.S. Patent No. 6,416,135. Claim 9 stands rejected as being obvious under 35 U.S.C. §103 over Stroh in view of Sommerer and Greubel et al.

and further in view of Pazdirek et al., U.S. Patent No. 6,505,989.

The rejection of claims 1-12 is appealed.

IV. STATUS OF AMENDMENTS

A Response After Final was filed on February 15, 2005. No amendments to the claims have been filed after the Final Office Action of November 15, 2004. An Advisory Action dated March 2, 2005 indicated that the request for reconsideration set forth in the Response After Final was considered and did not place the application in a condition for allowance.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates to an apparatus comprising a first suspension member 12 and a second suspension member 14. (Page 2, lines 7-11). The second suspension member 14 has opposite first and second side surfaces 20 and 22, respectively. (Page 4, lines 9-10). A through hole 24 extends between the first and second side surfaces 20 and 22. (Page 4, lines 1-12). A first frustoconical surface 32 defines a first end 30 of the through hole 24. (Page 4, lines 16-18). A second frustoconical surface 36 defines a second

end 34 of the through hole 24. (Page 5, lines 1-4). The first frustoconical surface 32 is angled so that imaginary lines extending from diametrically opposite portions of the first frustoconical surface intersect at a first location within the through hole 24 and between the first and second side surfaces 20 and 22 of the second suspension member 14. (Figs. 1 and 2). The second frustoconical surface 36 also is angled so that imaginary lines extending from diametrically opposite portions of the second frustoconical surface intersect at a second location within the through hole 24 and between the first and second side surfaces 20 and 22. (Figs. 1 and 2).

A cylindrical surface 28 is interposed between and connects the first and second frustoconical surfaces 32 and 36. (Page 4, line 16 to page 5, line 4; and Fig. 2). The cylindrical surface 28 defines a central portion of the through hole 24. (Fig. 2). The cylindrical surface 28 extends parallel to an axis 26 of the through hole 24. (Page 4, lines 12-15). In one embodiment of the invention, the first and second frustoconical surfaces 32 and 36 extend at 45 degree angles relative to the axis 26. (Page 4, line 16 to page 5, line 7).

The apparatus also includes a ball joint 10 that supports the first suspension member 12 relative to the second suspension member 14. (Page 3, lines 15-17). The ball joint 10 includes a socket 40 and a ball stud 50. (Page 5, lines 8-9). The socket 40 is connected with the first suspension member 12. (Page 5, lines 11-12). The ball stud 50 is a one-piece stud having a ball end portion 52 and a shank portion 60. (Page 5, line 15 to page 6, line 1).

The socket 40 of the ball joint 10 supports the ball end portion 52 of the ball stud 50 for pivotal movement. (Page 5, lines 15-21). The shank portion 60 of the ball stud 50 projects from the socket 40 and completely through the through hole 24 in the second suspension member 14. (Fig. 1).

The shank portion 60 of the ball stud 50 has a third frustoconical surface 66. (Page 6, lines 8-14). The ball stud 50 includes a longitudinal central axis on which the third frustoconical surface 66 is centered. (Figs. 1 and 2). The third frustoconical surface 66 extends at a first angle relative to the axis. In one embodiment of the invention, the third frustoconical surface 66 extends at a 45 degree angle relative to the axis. (Figs. 1 and 2).

The third frustoconical surface 66 engages the first frustoconical surface 32 of the second suspension member 14. (Page 9, lines 1-4, and Figs. 1 and 2). The third frustoconical surface 66 is angled so that, when in engagement with the first frustoconical surface 32, imaginary lines extending from diametrically opposite portions of the third frustoconical surface intersect at a third location within the through hole 24 of the second suspension member 14 and between the first and second side surfaces 20 and 22. (Figs. 1 and 2).

The shank portion 60 of the ball stud 50 also includes a cylindrical portion 68. (Page 6, lines 15-18; and Fig. 2). The cylindrical portion 68 includes a cylindrical outer surface 70. (Page 6, lines 18-19). The cylindrical outer surface 70 has a smaller diameter than the smallest diameter of the third frustoconical surface 66. (Fig. 2). When the third frustoconical surface 66 is in engagement with the first frustoconical surface 32 of the second suspension member 14, the cylindrical portion 68 of the shank portion 60 of the ball stud 50 is spaced away from and extends parallel to the cylindrical surface 28 of the second suspension member 14. (Fig. 2).

The ball joint 10 also includes a nut 90. (Page 7, line 15). The nut 90 is secured to the shank portion 60 of the ball stud 50. (Page 8, lines 13-15; and Figs. 1 and 2). The nut 90 has a fourth frustoconical surface 96 that engages the second frustoconical surface 36 of the second suspension member 14. (Page 7, lines 18-21; page 8, lines 15-18; and Figs. 1 and 2). The fourth frustoconical surface 96 is angled so that, when in engagement with the second frustoconical surface 36, imaginary lines extending from diametrically opposite portions of said fourth frustoconical surface 96 intersect at a fourth location within the through hole 24 of the second suspension member 14 and between the first and second side surfaces 20 and 22. (Figs. 1 and 2). When securing the second suspension member 14 to the ball stud 50, the fourth frustoconical surface 96 of the nut 90 extends at the same angle relative to axis 26 as the second frustoconical surface 36 of the second suspension member. (Figs. 1 and 2).

The shank portion 60 of the ball stud 50 extends completely through the nut 90. (Figs. 1 and 2) The nut 90 causes the first and third frustoconical surfaces 32 and 66 to be pressed together and causes the second and fourth frustoconical surfaces 36 and 96 to be pressed together to

secure the second suspension member 14 relative to the shank portion 60 of the ball stud 50. (Page 8, lines 7-22).

VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether the rejection of claims 1-12 as failing to meet the written description requirement of 35 U.S.C. §112, first paragraph is proper?

2. Whether the rejection of claims 1, 5-8, and 10-12 as being obvious under 35 U.S.C. §103 over Stroh in view of Sommerer is proper?

3. Whether the rejection of claims 2-4 as being obvious under 35 U.S.C. §103 over Stroh in view of Sommerer and Greubel et al. is proper?

Grouping of claims:

Claims 1-12 stand or fall independently of one another.

VII. ARGUMENTS

A. The Written Description Rejection of claims 1-12.

The written description requirement arises from the language of 35 U.S.C. §112, first paragraph. Vas-Cath Inc. v. Mahurkar, 935 F.2d 1555, 1560 (Fed. Cir. 1991). A primary

purpose of the written description requirement is to insure that the applicant had possession of the concept of the claimed subject matter at the time of filing of the application. Id. at 1562 citing In re Smith and Hubin, 481 F.2d 910, 914 (CCPA 1973). To satisfy the written description requirement, the disclosure "does not have to describe exactly the subject matter claimed." Id. at 1564. The test for determining whether an application meets the written description requirement of 35 U.S.C. §112, first paragraph is "whether the disclosure of the application relied upon reasonably conveys to a person skilled in the art that the inventor had possession of the claimed subject matter at the time of the filing date." Eiselstein v. Frank, 52 F.3d 1035, 1039 (Fed. Cir. 1995). In showing that one of ordinary skill in the art would recognize the claimed subject matter in the disclosure, the applicant may rely upon the subject matter disclosed in the specification, the drawings, and the originally filed claims. See generally, Vas-Cath Inc., 935 F.2d at 1565, and In re Gardner, 178 USPQ 149 (CCPA 1973).

In rejecting claims 1-12 for failing to meet the written description requirement of 35 U.S.C. §112, first paragraph,

the Office Action of November 15, 2004, at page 3, states that the "[a]pplicant cannot rely on the figures as the figures are not to scale." The M.P.E.P. addresses proportions in drawings when discussing the teachings of a prior art reference by stating "[w]hen the reference does not disclose that the drawings are to scale and is silent as to dimensions, arguments based on measurements of the drawing features are of little value." M.P.E.P. §2125 citing Hockerson-Halberstadt, Inc. v. Avia Group Int'l, 222 F.3d 951, 956 (Fed. Cir. 2000).

The M.P.E.P. is silent as to proportions in figures of an applicant's disclosure for the purposes of meeting the written description requirement of 35 U.S.C. §112, first paragraph. The M.P.E.P., however, states that an applicant may show possession of the claimed invention by disclosure in the drawings. M.P.E.P. §2163(II)(A)(3)(a) citing Vas-Cath Inc., 935 F.2d at 1565. The drawings of the present invention, particularly, Fig. 2, clearly show that the distance between the first and second sides 20 and 22 of the second suspension member 14 is such that imaginary lines extending from diametrically opposite portions of the first and second frustoconical surfaces intersect within the through-hole. The

drawings also clearly show that imaginary lines extending from diametrically opposite portions of the third and fourth frustoconical surfaces, when in engagement with the first and second frustoconical surfaces, respectively, intersect within the through-hole. Thus, the disclosure of the present invention supports these features of claim 1 and the written description rejection of claims 1-12 is improper.

Moreover, contrary to the statement in the Office Action, Figs. 1 and 2 of the application are drawn to scale. An engineering drawing of the ball stud and a portion of a steering arm (i.e., the second suspension member) that formed a portion of the original invention disclosure submitted by the Applicant was attached to the Response After Final to illustrate that Figs. 1 and 2 of the present application were drawn to scale. The engineering drawing is attached to this brief as Appendix B. A comparison of the ball stud of the engineering drawing and Figs. 1 and 2 of the present application shows that Figs. 1 and 2 were drawn to scale and that the relative relationship of the angles of the frustoconical surfaces and the thickness of the second suspension member in Figs. 1 and 2 is accurate and in

proportion to similar structures in the drawing. Since Figs. 1 and 2 are drawn to scale and disclose each feature of claim 1, it is respectfully submitted that the present application conveys to one skilled in the art that, at the time of filing of the present invention, the inventor had possession of the claimed subject matter. Therefore, the written description rejection of claims 1-12 is improper and should be withdrawn.

B. The Obviousness Rejection of claim 1.

Claim 1 patentably defines over Stroh, Sommerer, and Greubel et al., whether taken singularly or in combination, for at least the following reasons:

- 1. None of Stroh, Sommerer, and Greubel et al. teaches or suggests a second suspension member having a through-hole with first and second frustoconical surfaces, as recited in claim 1.**

Claim 1 recites that the first frustoconical surface is angled so that imaginary lines extending from diametrically opposite portions of the first frustoconical surface intersect at a first location within the through-hole and between the first and second side surfaces of the second suspension

member. Claim 1 also recites that the second frustoconical surface is angled so that imaginary lines extending from diametrically opposite portions of the second frustoconical surface intersect at a second location within the through-hole and between the first and second side surfaces of the second suspension member. None of Stroh, Sommerer, and Greubel et al. teaches or suggests a second suspension member having first and second frustoconical surfaces with the features recited in claim 1.

Stroh fails to teach or suggest first and second frustoconical surfaces. In Sommerer, the first and second frustoconical surfaces of the through hole of the ring 10 of Fig. 2 are not angled so that imaginary lines extending from diametrically opposite portions of the frustoconical surfaces intersect at locations within the through-hole and between the first and second side surfaces of the ring 10. Particularly, the lowermost frustoconical surface of the through hole of the ring 10 of Fig. 2 of Sommerer is angled such that imaginary lines extending from diametrically opposite portions of the frustoconical surface intersect at a location outside of the through-hole in the ring 10. Greubel et al. also fails to

teach the first and second frustoconical surfaces of claim 1. Thus, the record in this case is totally devoid of a teaching or suggestion of frustoconical surfaces having the features recited in claim 1. As a result, there is no motivation for combining and modifying the references in the manner proposed by the Examiner. Therefore, the rejection of claim 1 is improper and should be withdrawn.

Moreover, it is respectfully suggested that a combination of Stroh, Sommerer, and Greubel et al. only seems plausible using hindsight after having the benefit of the Applicant's disclosure. The use of the teachings of the present invention to find obviousness is impermissible.

2. None of Stroh, Sommerer, and Greubel et al. teaches or suggests a one-piece stud having a second end portion with a third frustoconical surface, as recited in claim 1.

Claim 1 recites a one-piece stud that has a second end portion having a third frustoconical surface that is in engagement with the first frustoconical surface of the second suspension member. Claim 1 further recites that the third frustoconical surface is angled so that, when in engagement

with the first frustoconical surface, imaginary lines extending from diametrically opposite portions of the third frustoconical surface intersect at a third location within the through-hole and between the first and second side surfaces of the second suspension member.

With regard to the configuration of the stud, the references are defective for the following reasons:

a. Stroh:

Stroh fails to disclose a one-piece stud having a frustoconical surface.

b. Sommerer:

1. Sommerer fails to disclose a one-piece stud.
2. The frustoconical surface of the stud of Sommerer fails to include the features of the third frustoconical surface of claim 1. Particularly, Sommerer fails to teach or suggest that the frustoconical surface of the stud, which abuts against the lowermost tapered surface of the through hole of ring 10, as shown in Fig. 2 of Sommerer, is angled so that imaginary lines extending from diametrically opposite portions of the frustoconical

surface intersect at a location within the through-hole and between the first and second side surfaces of the ring 10. With reference to Fig. 2 of Sommerer, imaginary lines extending from diametrically opposite portions of the frustoconical surface of the stud clearly intersect at a location outside the through-hole in the ring 10.

b. Greubel et al.:

Greubel et al. fails to disclose a stud having a frustoconical surface.

Thus, the record is totally devoid of a teaching or suggestion, either in the references or in the knowledge of one of ordinary skill in the art, of a one-piece stud that has a second end portion having a third frustoconical surface, as recited in claim 1. Therefore, the rejection of claim 1 as obvious is improper and should be withdrawn.

3. There is no teaching or suggestion in the references to modify the embodiment of Fig. 3 of Stroh to include frustoconical surfaces.

In rejecting claim 1, the Examiner proposes to modify Fig. 3 of Stroh to include frustoconical surfaces "to mate or align parts together." In proposing to modify Fig. 3 of Stroh, the Examiner concludes that spherical and frustoconical surfaces are equivalent for providing the mating and aligning of parts. It is respectfully submitted that one of ordinary skill in the art will not recognize spherical and frustoconical surfaces as being equivalents. One of ordinary skill in the art will recognize frustoconical surfaces as being superior to spherical surfaces for aligning adjoining parts. Additionally, frustoconical surfaces provide at least one additional benefit over spherical surfaces. The Examiner completely ignores this additional benefit.

With regard to the alignment of adjoining parts, the spherical surface of Fig. 3 of Stroh requires the diameter of the recess 13 at the upper surface of the tie rod linkage 2 to be slightly larger than the diameter of the shank portion. If the diameter of the recess 13 is not larger than that of the

shank portion, the shank portion will not be easily received in the recess. As a result of the slightly larger diameter of the recess 13, a slight radial (side to side) movement of the shank portion in the recess 13 may occur. Such movement does not occur with mating frustoconical surfaces. Since frustoconical surfaces taper from a small diameter to a larger diameter, the mating of adjoining frustoconical surfaces results in contact between the adjoining frustoconical surfaces on all sides (i.e., about 360 degrees of the shank portion of the stud). As a result, the mating frustoconical surfaces prevent radial movement of the shank portion relative to the recess. Thus, one skilled in the art will recognize that frustoconical surfaces provide superior alignment between adjoining parts than the spherical surfaces of Fig. 3 of Stroh.

Moreover, frustoconical surfaces provide the additional benefit of providing a radial component to the clamping force holding the adjoining parts together. Spherical surfaces fail to provide a radial component to the clamping force. With reference to Fig. 3 of Stroh, one of ordinary skill in the art will recognize that, when the shank portion 10 and the tie rod

linkage 2 come together, the contact between the shoulder 12 and the tie rod linkage is along a bottom surface of the recess 13. As a result, the clamping force between the shank portion 10 and the tie rod linkage 2 has only an axial component, vertical as viewed in Fig. 3 of Stroh (i.e., normal to the contacting surfaces and in a direction parallel to a central axis of the shank portion). Contrarily, when frustoconical surfaces are provided on the stud and the suspension member, as shown in Fig. 2 of Sommerer, contact between the surface of the stud and the surface of the suspension member (i.e., ring 10) occurs at the angle of the frustoconical surfaces. Thus, a clamping force between the stud and the suspension member includes a component that is oriented radially relative to an axis of the through hole (i.e., normal to the contacting surfaces). The additional benefit of frustoconical surfaces providing a radial component to the clamping force also illustrates to one of ordinary skill in the art that spherical and frustoconical surfaces are not equivalent.

Thus, spherical and frustoconical surfaces are not interchangeable as being equivalent, as has been suggested by

the Examiner. As a result, there is no motivation either in the references themselves or to one of ordinary skill in the art to modify the embodiment of Fig. 3 of Stroh to include frustoconical surfaces. For this reason, the rejection of claim 1 is improper and should be withdrawn.

Moreover, Fig. 4 of Stroh discloses an embodiment in which the tie rod 2 has a tapered (or frustoconical) recess 17 and the shank portion 10 has a tapered (or frustoconical) surface for mating of the shank portion 10 and the tie rod 2. Instead of looking elsewhere in the art for ways to modify the embodiment of Fig. 3 of Stroh for providing a more precise alignment of the shank portion 10 and the tie rod 2, one of ordinary skill in the art would simply look to the teachings of Fig. 4 of Stroh for providing a recess with a single tapered surface. Since one of ordinary skill in the art would not look outside of the teaching of Stroh for providing a recess with a frustoconical surface and a corresponding shank portion of a stud, there is no motivation for the proposed modification of the embodiment of Fig. 3 of Stroh with the frustoconical surfaces of Sommerer and Greubel et al.

Therefore, the rejection of claim 1 is improper and should be withdrawn.

C. The Obviousness Rejection of claim 5.

Claim 5 depends from claim 1 and is allowable for at least the same reasons as claim 1. Additionally, claim 5 recites that the fastener is a nut and that the second end portion of the stud has a threaded end portion for receiving the nut. The threaded end portion of the stud extends to a shoulder that forms an end of the third frustoconical surface. The record is totally devoid of a stud having a threaded end portion that extends to a shoulder forming an end of a frustoconical surface of the stud. Therefore, the rejection of claim 5 is improper and should be withdrawn.

D. The Obviousness Rejection of claim 6.

Claim 6 depends from claim 1 and is allowable for at least the same reasons as claim 1. Additionally, claim 6 recites that the stud has a cylindrical portion extending from the third frustoconical surface in a direction away from the

first end portion of the stud. The cylindrical portion has a smaller diameter than the smallest diameter of the third frustoconical surface. The cylindrical portion of the second end portion of the stud is spaced away from and extends parallel to the cylindrical surface of the second suspension member when the third frustoconical surface is in abutting engagement with the first frustoconical surface. The cylindrical surface of the second end portion includes external threads for receiving the fastener. The external threads extend axially to the third frustoconical surface. The record in this case is devoid of a teaching or suggestion of a stud having a threaded end portion that extends to a shoulder forming an end of a frustoconical surface of the stud. Therefore, the rejection of claim 6 is improper and should be withdrawn.

E. The Obviousness Rejection of claim 7.

Claim 7 depends from claim 1 and is allowable for at least the same reasons as claim 1. Additionally, claim 7 recites that the third frustoconical surface extends at a first angle relative to a central axis of the stud. Claim 7

also recites that the fourth frustoconical surface, when the fastener is secured to the second end portion of the stud, also extends at the first angle. The record in this case is totally devoid of a teaching or suggestion of a frustoconical surface of the stud and a frustoconical surface of the fastener extending at the same angle relative to a central axis of the stud. Furthermore, combining the teachings of Stroh, Sommerer, and Greubel et al. to meet this feature of claim 7 only seems plausible using hindsight after having the benefit of the Applicant's disclosure. The use of the teachings of the present invention to find obviousness is impermissible. Therefore, the rejection of claim 7 is improper and should be withdrawn.

F. The Obviousness Rejection of claim 8.

Claim 8 depends from claim 1 and is allowable for at least the same reasons as claim 1. Additionally, claim 8 recites that the second end portion of the stud has a cylindrical portion that extends from the third frustoconical surface in a direction away from the first end portion of the stud. The cylindrical portion has a smaller diameter than the

smallest diameter of the third frustoconical surface. The cylindrical portion of the second end portion of the stud is spaced away from and extends parallel to the cylindrical surface of the second suspension member when the third frustoconical surface is in abutting engagement with the first frustoconical surface. None of Stroh, Sommerer, and Greubel et al. teaches or suggests the features of claim 8. Therefore, the rejection of claim 8 is improper and should be withdrawn.

G. The Obviousness Rejection of claim 12.

Claim 12 depends from claim 1 and is allowable for at least the same reasons as claim 1. Additionally, claim 12 recites that the first and third locations within the through hole of the second suspension member are identical locations and the second and fourth locations within the through hole of the second suspension member are identical locations. None of Stroh, Sommerer, and Greubel et al. teaches or suggests the features of claim 12. Therefore, the rejection of claim 12 is improper and should be withdrawn.

H. The Obviousness Rejection of claim 2.

Claim 2 patentably defines over Stroh, Sommerer, and Greubel et al. for reasons similar to those set forth above with regard to claim 1. Additionally, claim 2 recites that the third frustoconical surface of the stud and the first and second frustoconical surfaces of the second suspension member extend at the same angle, a first angle, relative to a central axis of the stud. The record is devoid of a teaching or suggestion of a frustoconical surface of the stud and two frustoconical surfaces of a suspension member extending at the same angle relative to a central axis of the stud. Therefore, the rejection of claim 2 is improper and should be withdrawn.

I. The Obviousness Rejection of claim 3.

Claim 3 depends from claim 2 and is allowable for at least the same reasons as claim 2. Additionally, claim 3 recites that the fourth frustoconical surface also extends at the first angle relative to the axis when the fastener is secured to the second end portion of the stud. The record also is devoid of a teaching or suggestion of a frustoconical surface of the fastener extending at the same angle relative

to the axis of the stud as the frustoconical surface of the stud and two frustoconical surfaces of the suspension member. Therefore, the rejection of claim 3 is improper and should be withdrawn.

J. The Obviousness Rejection of claim 4.

Claim 4 depends from claim 2 and is allowable for at least the same reasons as claim 2. Additionally, claim 4 recites that the third frustoconical surface extends at a 45 degree angle to the axis. None of Stroh, Sommerer, and Greubel et al. teaches or suggests the third frustoconical surface extending at a 45 degree angle to the axis. Therefore, the rejection of claim 4 is improper and should be withdrawn.

K. Conclusion

In view of the foregoing, Appellant respectfully submits that claims 1-12 are allowable. Reversal of the rejections of claims 1-12 is respectfully requested.

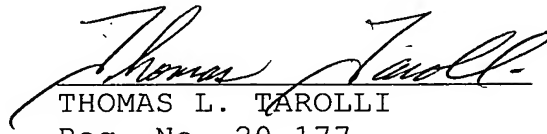
VIII.

APPENDICES

The attached Appendix A contains a copy of the claims on appeal. The attached Appendix B contains an engineering drawing of the ball stud of the ball joint and a portion of the steering arm.

Please charge any deficiency or credit any overpayment in the fees for this Appeal Brief to Deposit Account No. 20-0090.

Respectfully submitted,


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Appendix A

Claim 1 Apparatus comprising:

a first suspension member;

a second suspension member having opposite first and second side surfaces and a through hole that extends between the first and second side surfaces, a first frustoconical surface defining a first end of said through hole and a second frustoconical surface defining a second end of said through hole, said first frustoconical surface being angled so that imaginary lines extending from diametrically opposite portions of said first frustoconical surface intersect at a first location within said through hole and between said first and second side surfaces, said second frustoconical surface being angled so that imaginary lines extending from diametrically opposite portions of said second frustoconical surface intersect a second location within said through hole and between said first and second side surfaces, a cylindrical surface interposed between and connecting said first and second frustoconical surfaces, said cylindrical surface defining a central portion of said through hole;

a socket connected with said first suspension member;

a one-piece stud having a first end portion and a second end portion;

said socket supporting said first end portion of said stud in said socket for pivotal movement relative to said socket;

said second end portion of said stud projecting from said socket and completely through said through hole in said second suspension member, said second end portion of said stud having a third frustoconical surface in engagement with said first frustoconical surface of said second suspension member, said third frustoconical surface being angled so that, when in engagement with said first frustoconical surface, imaginary lines extending from diametrically opposite portions of said third frustoconical surface intersect at a third location within said through hole of said second suspension member and between said first and second side surfaces; and

a fastener secured to said second end portion of said stud, said fastener having a fourth frustoconical surface in engagement with said second frustoconical surface of said second suspension member, said fourth frustoconical surface being angled so that, when in engagement with said second frustoconical surface, imaginary lines extending from

diametrically opposite portions of said fourth frustoconical surface intersect at a fourth location within said through hole of said second suspension member and between said first and second side surfaces, said second end portion of said stud extending completely through said fastener and said fastener causing said first and third frustoconical surfaces to be pressed together and causing said second and fourth frustoconical surfaces to be pressed together to secure said second suspension member relative to said second end portion of said stud;

said socket and said stud supporting said first suspension member for movement relative to said second suspension member.

Claim 2 Apparatus comprising:

a first suspension member;

a second suspension member having a through hole with a first frustoconical surface defining a first end of said through hole and a second frustoconical surface defining a second end of said through hole, said first and second frustoconical surfaces converging toward a center of said second suspension member, a cylindrical surface interposed

between said first and second frustoconical surfaces and defining a central portion of said through hole;

a socket connected with said first suspension member;

a one-piece stud having a first end portion and a second end portion;

said socket supporting said first end portion of said stud in said socket for pivotal movement relative to said socket;

said second end portion of said stud projecting from said socket and completely through said through hole, said second end portion of said stud having a third frustoconical surface in engagement with said first frustoconical surface of said second suspension member; and

a fastener secured to said second end portion of said stud, said fastener having a fourth frustoconical surface in engagement with said second frustoconical surface of said second suspension member, said second end portion of said stud extending completely through said fastener and said fastener causing said first and third frustoconical surfaces to be pressed together and causing said second and fourth frustoconical surfaces to be pressed together to secure said

second suspension member relative to said second end portion of said stud;

said socket and said stud supporting said first suspension member for movement relative to said second suspension member,

wherein said stud has a longitudinal central axis on which said third frustoconical surface is centered, said third frustoconical surface extending at a first angle relative to said axis, said first and second frustoconical surfaces of said second suspension member also extending at said first angle relative to said axis.

Claim 3 Apparatus as set forth in claim 2 wherein said fourth frustoconical surface also extends at said first angle relative to said axis when said fastener is secured to said second end portion of said stud.

Claim 4 Apparatus as set forth in claim 2 wherein said third frustoconical surface extends at a 45 degree angle to said axis.

Claim 5 Apparatus as set forth in claim 1 wherein said fastener is a nut and said second end portion of said stud has a threaded end portion for receiving said nut, said threaded end portion of said stud extending to a shoulder that forms an end of said third frustoconical surface.

Claim 6 Apparatus as set forth in claim 1 wherein said second end portion of said stud has a cylindrical portion extending from said third frustoconical surface in a direction away from said first end portion of said stud, said cylindrical portion having a smaller diameter than the smallest diameter of said third frustoconical surface, said cylindrical portion of said second end portion of said stud being spaced away from and extending parallel to said cylindrical surface of said second suspension member when said third frustoconical surface is in abutting engagement with said first frustoconical surface, said cylindrical surface of said second end portion including external threads for receiving said fastener, said external threads extending axially to said third frustoconical surface.

Claim 7 Apparatus as set forth in claim 1 wherein said stud has a longitudinal central axis on which said third frustoconical surface is centered, said third frustoconical surface extending at a first angle relative to said axis, said first and second frustoconical surfaces also extending at said first angle relative to said axis, said fourth frustoconical surface also extending at said first angle to said axis when said fastener is secured to said second end portion of said stud, said fastener being a nut and said second end portion of said stud having a threaded end portion for receiving said nut.

Claim 8 Apparatus as set forth in claim 7 wherein said second end portion of said stud has a cylindrical portion extending from said third frustoconical surface in a direction away from said first end portion of said stud, said cylindrical portion having a smaller diameter than the smallest diameter of said third frustoconical surface, said cylindrical portion of said second end portion of said stud being spaced away from and extending parallel to said cylindrical surface of said second suspension member when said

third frustoconical surface is in abutting engagement with said first frustoconical surface.

Claim 9 Apparatus as set forth in claim 1 wherein said second end portion of said stud includes a terminal end having a hexagonal configuration, said terminal end being located on a side of said fastener opposite said first end portion when said fastener is secured to said second end portion of said stud.

Claim 10 Apparatus as set forth in claim 1 wherein said first frustoconical surface and said cylindrical surface converge with one another in said through hole of said second suspension member and wherein said second frustoconical surface and said cylindrical surface converge with one another in said through hole in said second suspension member.

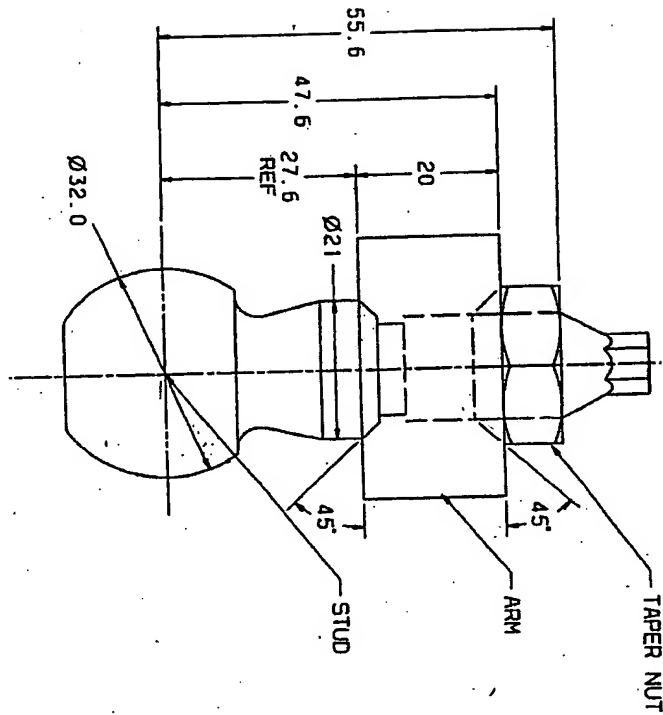
Claim 11 Apparatus of claim 10 wherein said cylindrical surface extends from said first frustoconical surface to said second frustoconical surface so that said first and second frustoconical surfaces and said cylindrical surface entirely form said through hole in said second suspension member.

Claim 12 Apparatus of claim 1 wherein said first and third locations within said through hole of said second suspension member are identical locations and wherein said second and fourth locations within said through hole of said second suspension member are identical locations.

Serial No. 10/047,534

Appendix B
















Stud Assembly drawing no. L0-188 attached.

[illegible]

20.

881-188

GEOMETRIC DRAWING SYMBOLS

- | | |
|---|--|
|  CIRCULAR RUNOUT
 TOTAL RUNOUT
 STRAIGHTNESS
 CIRCULAR RUNOUT
 CIRCULAR RUNOUT
 CIRCULAR RUNOUT
 CIRCULAR RUNOUT
 CIRCULAR RUNOUT
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 CIRCULAR RUNOUT
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 CIRCULAR RUNOUT
 CIRCULAR RUNOUT
 CIRCULAR RUNOUT | <p>FLATNESS</p> <p>⊕ TANGENT PLANE POSITION</p> <p>⊖ PROFILE OF A LINE</p> <p>⊥ PERPENDICULARITY</p> <p>⌒ PROFILE OF A SURFACE</p> <p>① LEAST MATERIAL CONDITION</p> <p>② REPRODUCES OR FEATURE SIZE</p> <p>③ MAXIMUM MATERIAL CONDITION</p> |
|---|--|

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SCALE THIS DRAWING
ALL DIMENSIONS IN MILLIMETERS

[illegible]

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REF.	COMPLETED	CHK. DATE	APP. DATE	REL. DATE	SCALE
DRAWN BY	5-PT	DRAWER DATE	APPROVAL DATE	RELEASE DATE	2:1
DO NOT SCALE	TOLERANCES NOT OTHERWISE SPECIFIED				
MATERIAL	DIMENSIONS ±0.5 ANGULAR ±2°				
PROCESS					

METRIC

NAME	STUD ASSLY
NO.	L0-188

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